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Preface

Vibrational microscopic imaging

1. Introduction

The editors would like to thank BBA for providing a forum for presenting to a wide audience the current state of vibrational microscopic imaging, a novel and rapidly developing form of IR and Raman spectroscopy. The coupling of IR and Raman spectrometers with array detectors and optical microscopes provides a new and powerful means for characterizing normal and pathological states of tissues. The technology generates vast amounts of data. For example, the editors routinely collect 10,000–40,000 IR spectra from single tissue sections. This overwhelming number of data points (at 100–1000 points per spectrum, with tens to hundreds of sections required for a study of pathological states), evidently precludes visual examination of each spectrum and has required the application of multivariate statistical methods for efficient data analysis.

The 17 articles presented in this issue by leading practitioners around the world span a diverse range of technical and biomedical issues which serve to illustrate the inherent power of the technology.

A central focus of vibrational microscopic imaging has been to classify pathological states of brain/neural tissue (Krafft, Amharref, Wood, Kretlow), vascular (Bonnier), breast (Fabian), liver (Liu), bone (Boskey), and cartilage (Camacho) tissue. These applications are well represented in this issue, as noted through the above listing of the first author in each instance.

A second focus of the issue is the consideration of technical matters. Miller describes the improved IR spectral resolution and quality available from synchrotron sources, while Golchuk, Kazarian, Lasch, and Bhargava and their respective co_workers discuss various issues of tissue sampling and data analysis.

Finally, the editors exhibit their age and biases by insisting that an understanding of tissue or cellular spectra is an essential and perhaps underrepresented element of the current enterprise. Thus, vibrational microscopy is shown to offer unique advantages over other imaging technologies by providing direct structural information from the molecular components (Mendelsohn) or individual cells (two articles from the Diem lab) that constitute tissues.

This field is at a turning point. From a few isolated practitioners in the late 1980s and early 1990s, the two most recent conferences in this field (named Spec 2004 and Spec 2006) in Newark, New Jersey (June 2004) and Heidelberg, Germany (May 2006), attracted ~125 and 200 participants, respectively. For the field to grow, the participation of physicians must be solicited and encouraged. Although most of the current authors have worked hard to develop medical collaborators, a gap nevertheless remains in the mindset of the medical community, which is largely unaware that this technology can aid them in a variety of their diagnostic tasks. It is the editors' fondest hope that issues such as this, coupled with technical publications in the primary medical literature, can overcome the intellectual barriers that yet remain between the scientific and medical worlds.

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